

4. OUR WORK AND ITS PLACE IN NASA'S MISSION

NASA's Enterprises

NASA's overall program, as outlined in the Agency's strategic plan, is composed of five enterprises:

- Earth Science
- Space Science
- Aerospace Technology
- Biological and Physical Research
- Human Exploration and Development of Space

The Laboratory for Atmospheres concentrates on two of these, the Earth Science and Space Science Enterprises.

Earth Science

The mission of NASA's Earth Science Enterprise (ESE) is to develop our understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. Within this enterprise, the Laboratory for Atmospheres addresses both short-term weather forecasting and long-term climate studies. The wide array of our work reflects the Laboratory's history of atmospheric research, from the early days of weather satellites and emphasis on weather forecasting to our present focus on global climate change. Our goal is to increase the accuracy and lead-time with which we can predict weather and climate change.

In support of the U.S. Global Change Research Program and the U.S. Weather Research Program, the Earth Science divisions of the Earth Science Enterprise have established certain priorities:

- Atmospheric Chemistry
- Biology and Biogeochemistry of Ecosystems, and the Global Carbon Cycle
- Climate Variability and Prediction
- Global Water and Energy Cycles
- Solid Earth Science

The Laboratory for Atmospheres conducts basic and applied research in most of these priority areas.

Specifically, Laboratory scientists focus their efforts on the following areas:

- Aerosols and radiation
- Atmospheric hydrological processes
- Atmospheric ozone and trace gases
- Climate variability
- Mesoscale processes

Our work involves four primary activities or products: measurements, data sets, data analysis, and modeling. Table I depicts these activities and the topics they address.

Table I: Laboratory for Atmospheres Earth Science Activities

Measurements	Data Sets	Data Analysis	Modeling
Space Aircraft Balloon Ground Field campaigns	DAO assimilated products Global precipitation TOMS aerosols TOMS surface UV TOMS total ozone TOVS Pathfinder TRMM validation products	Aerosols Climate variability and climate change Clouds and precipitation Global temperature trends Ozone and trace gases Radiation UV-B measurements Validation studies	Atmospheric chemical Clouds and mesoscale Coupled climate/ocean General circulation Radiation transfer Retrievals and data assimilation

The divisions among measurements, data sets, data analysis, and modeling are somewhat artificial, in that activities in one area often affect those in another. These activities are strongly interlinked and cut across science priorities and the organizational structure of the Laboratory. The grouping corresponds to the natural processes of carrying out scientific research: ask the scientific question, identify the variable needed to answer it, conceive the best instrument to measure the variable, analyze the data, and ask the next question.

Space Science

The mission of NASA's Space Science Enterprise is to solve mysteries of the universe; explore the solar system; discover planets around other stars; search for life beyond Earth; chart the evolution of the universe; and understand its galaxies, stars, planets, and life. Within this enterprise, the Laboratory studies the evolution, composition, and dynamics of the atmospheres of other planets. We have flown instruments on the Atmosphere Explorers, Dynamics Explorer, Pioneer Venus Orbiter, and Galileo missions. These instruments have measured ion and neutral gas composition, neutral gas temperature and wind, and electron temperature and density.

Laboratory for Atmospheres scientists have completed work on two instruments flying on the Cassini mission. The Gas Chromatograph Mass Spectrometer (GCMS) will measure the chemical composition of gases and aerosols in the atmosphere of Titan. The Ion and Neutral Mass Spectrometer (INMS) will measure the chemical composition of positive and negative ions and neutral species in the inner magnetosphere of Saturn and in the vicinity of Saturn's icy satellites.

Laboratory scientists have also completed work on a Neutral Mass Spectrometer (NMS) to measure the neutral atmosphere of Mars. That instrument is being flown on a joint mission with Japan called *Nozomi*. *Nozomi* is scheduled to arrive at Mars in December 2003.

The Neutral Gas and Ion Mass Spectrometer (NGIMS) on the Comet Nucleus Tour (CONTOUR) mission was designed, built, and calibrated in our Laboratory. NGIMS was delivered to JHU/APL for integration on the CONTOUR spacecraft in December 2001. CONTOUR is scheduled for launch in July 2002. It will measure the abundance and isotope ratios for many neutral and ion species in the coma of each comet during the flyby. These measurements, together with data from a dust experiment on this mission, will contribute to our understanding of the chemical composition of the nucleus itself and will allow us to study differences between the comets. The first comet encounter, with Encke, is planned for November 2003.